

2022 INNOVATION CHAMPIONS CONTEST

Hydraulic Side Disc

COUNTY: Rolette County Highway Department

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PROBLEM STATEMENT: Gravel and vegetation accumulate on road shoulders and ditches. Road shoulders start getting higher than the road. As a result, the road will not shed water, resulting in softened roadbeds and shoulders. Roads became slippery when it would rain because of a lack of rock. The moldboard on a maintainer was used to pull the shoulders, putting gravel along with grass and roots back onto the road. The vegetation and roots make it difficult to work the material back onto the road without leaving clumps, which in turn creates a safety issue for the motoring public. Some gravel roads in this county have up to 750 vehicles per day.

SOLUTION: Designed and built the hydraulic side disc. The operator runs the disc along the shoulder chopping the grass and disking the shoulder. On the second run, the disc does the same activity and the moldboard pulls the shoulder back onto the road. This is typically done at 5 MPH.

With the disc, the cut vegetation that comes up with the pulled shoulders makes working out the clumps more effective. The vegetation is being chopped continuously. The operator then does 2 more passes (at a minimum) working the gravel onto the roadbed to bringing it to the desired shape. Fewer passes are needed. Typically shoulder pulling is done in the spring of the year when vegetation is shorter. Cutting the vegetation prior to pulling shoulders onto the road is more effective.

The disc, on its own frame, is reinforced with angle iron and steel plates and attaches to the disc frame base with a hinge. The disc frame base is welded to the main base frame at a 45-degree angle. This was done to get the best cutting angle for the disc and to bypass the front wheel on the maintainer. The hydraulic cylinder attached to the tower on the frame adjusts the angle of the disc to the angle of the ditch. (The frame was designed and built considering the power of the maintainer and weight of the disc.) When parked the cylinder and disc are brought down to set on the ground. A safety arm and lock will be added to secure the hydraulic side disc while in transport to job location.

EQUIPMENT, MATERIAL and LABOR:

Equipment:

Welder
Cutting torch
Chop Saw
Grinder

Materials:

Salvage material:

horse drawn (JD) disc – 7' long
hydraulic cylinder – 3-inch diameter, 3' long with 1-1/2" shaft
cylinder bracket, steel plate – 3/4" thick
 7 1/2"x6 1/2"
 3"x 3"
 4 1/2" x 3 1/2"
(1) 20" rebar with ring (to hold hoses)

New material:

Main frame (attaches the maintainer):
(2) 5"x 34" steel plates – 1/2" thick (saddle mount harness to cat)
(2) 5" metal round tube (cut in half) (saddle mount harness to cat)
4x4" square tubing – 1/4" thick
(1) 46"
(1) 27"
(2) 6'
(2) 2" (cross bracing)
(2) 18" (bracing and reinforcement)
(2) 2x2" square tubing – 47", (reinforcement)
(1) 3" round tubing, 2' (jack length may vary)
(1) 5x5" steel plate (jack base)

Disc Frame

3x3 angle iron – 1/4 inch thick
(2) braces – 56" (disc frame)
(4) braces – 16" (disc frame braces)
(2) braces – 80 1/2"
(2) steel plates – 1/2" thick, 15" x 12" W

Hinge

2" metal tube,
(2) 3" ends (welded to rebar, to allow for pivoting)
(1) 11 1/2" (stationary)
1 – 1 1/2" pin, 20 1/2" L and 1 1/2" steel rod inside tube

Tower

2" x 6" tubing iron, 16" , 1/4" thick

2 Hoses (1/2" diameter) 21'

Labor Hours: *(includes time needed for design and discussion.)*

2 people

12 hours

COST SUMMARY:

25' - 4x4" square tubing = \$684

32' - 3x3" 1/4"-angle iron = \$549

6' - 1/4" flat iron = \$38

2 - 21' hoses = \$168

Total Cost: \$ 1,439 plus labor

SAVINGS AND BENEFITS: Less time is needed to work the material (gravel), pulled from the shoulders, back onto the road. Vegetation is cut and chopped, so material pulled on the road has fewer clumps. This makes it easier for the maintainer to lay out the retrieved gravel back onto the road. The probability of gravel/vegetation clumps left on the road is significantly reduced. Gravel back on the road reduces slipperiness when wet. All this increases safety for the motoring public. The hydraulic side disc increases safety for the motoring public, increases efficiencies and effectiveness for the road department, and results in a savings of time and money.

ANNUAL OPERATING COSTS:

Prior to using the innovation –he maintainer's moldboard was used for pulling shoulders. The moldboard does not chop/cut the grass and roots that came along when pulling shoulders. To work out forage clumps/mounds pulled up on the road, the operator would have to spend extra time working them from side to side. Grass would eventually deteriorate or get blown off the road by vehicles.

After using the innovation – Less time is spent working the gravel pulled from the shoulders back into and onto the roadbeds. The hydraulic side disc cuts the vegetation and eliminates the roots so clumps are less tightly bound. The operator runs only the disc on the shoulders for the 1st pass. On the 2d pass shoulders are pulled so gravel can be worked back onto the roadbed.

Hydraulic side disc in transport mode



Main base frame.



Disc base frame sets on Main frame at 45 degree angle.



Braces and supports on main base frame



Hydraulic side disc harness attachment.



Disc base frame



Cylinder attaches to tower and cylinder bracket on disc base frame



Tower for hydraulic cylinder





Hinge allows disc frame arm to flex





Hydraulic side disc



Video



Hydraulic Side
Disc.mp4